

Ray48

VHF Radio

Owner's Handbook

Document number: 81233-2
Date: February 2004

PURPOSE

THIS MANUAL CONTAINS VERY IMPORTANT INFORMATION ON THE INSTALLATION, OPERATION, AND MAINTENANCE OF YOUR NEW EQUIPMENT. TO GET THE BEST RESULTS IN OPERATION AND PERFORMANCE, PLEASE TAKE THE TIME TO READ THIS MANUAL THOROUGHLY.

*******IMPORTANT NOTICE*******

THIS DEVICE IS ONLY AN AID TO NAVIGATION. ITS ACCURACY CAN BE AFFECTED BY MANY FACTORS INCLUDING EQUIPMENT FAILURE OR DEFECTS, ENVIRONMENTAL CONDITIONS, AND IMPROPER HANDLING OR USE. IT IS THE USER'S RESPONSIBILITY TO EXERCISE COMMON PRUDENCE AND NAVIGATIONAL JUDGEMENT, AND THIS DEVICE SHOULD NOT BE RELIED UPON AS A SUBSTITUTE FOR SUCH PRUDENCE AND JUDGEMENT.

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NOTE

**“This device complies with PART 15 of the FCC Rules.
Operation is subject to the conditions that this device does
not cause harmful interference.”**

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GLOSSARY OF TERMS

VHF	Very High Frequency 30MHz to 300MHz
FM	Frequency Modulation
Carrier Wave	A Radio Frequency on which intelligence is superimposed.
Dual Watch	Monitor channel 16 while working on another channel.
Tri Watch	Monitor channel 16 and weather channel while working on another channel.
All Scan	Scans all channels
Memory Scan	Scans only user selected memory channels
US Channels	Channel designations as defined by the FCC
International Channel	Channel designator as defined by International Telecommunication Union
Weather Channels	Channels for routine and emergency weather information broadcast by NOAA
NOAA	National Oceanographic and Atmospheric Administration
RTCM	Radio Technical Commission for Maritime Services
Simplex	Transmit and receive on the same frequency
Duplex	Transmit and receive on different frequencies
Squelch	A circuit that sets the threshold for cutting off the receiver when the signal is too weak for reception of anything but noise.
LCD	Liquid Crystal Display
TX	Transmit
RX	Receiver
RF	Radio Frequency
CPU	Central Processing Unit
PLL	Phase Locked Loop (A type of frequency Synthesizer)
VCO	Voltage Controlled Oscillator
PTT switch	Microphone Push-To-Talk switch

SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

Congratulations on your purchase of Raymarine's Ray48 marine radiotelephone.

The Ray48 is a CPU-controlled, digitally synthesized, compact transceiver which provides reliable simplex and half-duplex (two-frequency) communications between ships and from ships at sea to public or private shore stations. The Ray48 provides two-way communications on the International and US channels, reception on 10 separate weather channels, and two-way communications on the International calling and safety channel (16).

This manual describes the physical and functional characteristics of the radiotelephone.

1.2 EQUIPMENT FEATURES

The Ray48 is designed and manufactured to provide ease of operation with excellent reliability. The important built-in features of the equipment are listed below.

- Submersible to IPX7 standard
- All solid-state circuitry for low current drain and maximum reliability.
- Series diode protection on input power circuits to prevent reverse polarity damage
- High-performance receiver section with optimum selectivity
- 54 channel transmit and 93 channel receive capability within the assigned VHF-FM maritime band.
- Exclusive circuit that automatically selects 16/9 (priority) channel when the radio is turned on.
- Exclusive weather alert feature (when in monitor mode).
- Selected channel number indicated on the LCD digital display.
- Key entries for "Quick" 16 PLUS, and 10 weather channels WX0 through WX9.
- All-Scan and Memory Scan features.

SECTION 2

INSTALLATION

2.1 UNPACKING AND INSPECTION

Use care when unpacking the unit from the shipping carton to prevent damage to the contents. It is also good practice to save the carton and the interior packing material. The original packing material should be used in the unlikely event it is necessary to return the unit to the factory.

2.2 EQUIPMENT SUPPLIED

The following is a list of materials supplied with the Ray48:

Description	Part No.
Ray48 White	E43020
Ray48 Charcoal	E43021
Handbook	81233
Power/External Speaker Cable	G623680-3
Microphone Bracket for White Radio	R49099
Microphone Bracket for Charcoal Radio	R49100
Mounting Yoke for White Radio	R49101
Mounting Yoke for Charcoal Radio	R49102
Yoke Knob w/Spacer for White Radio	R49094
Yoke Knob w/Spacer for Charcoal Radio	R49096

2.2.1 Optional Accessories

Description	Part No.
Flush Mount Kit	E46034

2.3 PLANNING THE INSTALLATION

When planning the installation for your Ray48, the following conditions should be considered to insure dependable and trouble-free operation.

- The mounting location should be easily accessible to allow operation of the front panel.
- The radio should be located at least 3 feet from the antenna.
- There should be adequate ventilation for the control unit.
- A sufficient space should be secured behind the transceiver to allow for proper cable connections to the rear panel connectors.

- The transceiver should be located as near to the power source as possible.
- The selected location should be as far apart as is possible from any devices that may cause interference such as motors, generators, and other on board electronics.
- Generally speaking, the transceiver should be protected from prolonged direct exposure to rain and salt spray. It is always a good practice to protect your valuable electronic equipment as much as possible.
- Use adequately sized wire for all DC power connections and make sure to solder all in-line connectors or splices.

2.3.1 Typical Mounting Methods

The Ray48 can be conveniently mounted on a chart table, bulkhead, overhead, or any other desired location (refer to Figure 2-1 for typical mounting methods).

CAUTION

Make sure there are no hidden electrical wires or other items behind the desired location before proceeding. Check that free access for mounting and cabling is available.

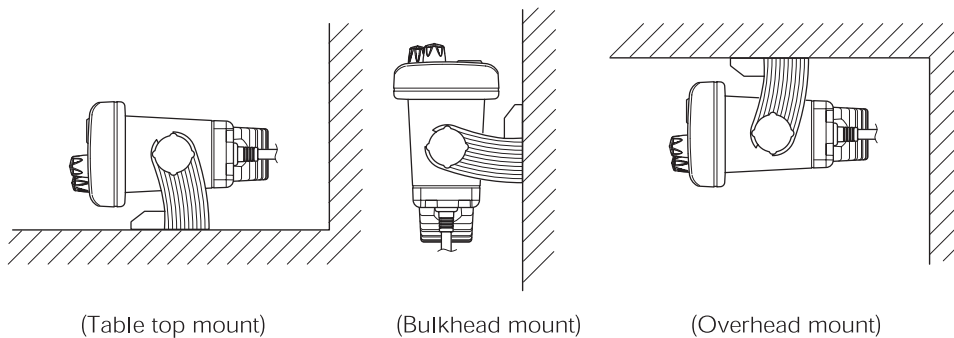


Fig.2-1 TYPICAL MOUNTING METHOD

2.3.2 Flush Mounting

In addition to the typical Mounting Methods, the Ray48 may also be flush mounted using the optional Flush Mount Kit (E46034). This kit is available from Raymarine Customer Service or your local Raymarine dealer.

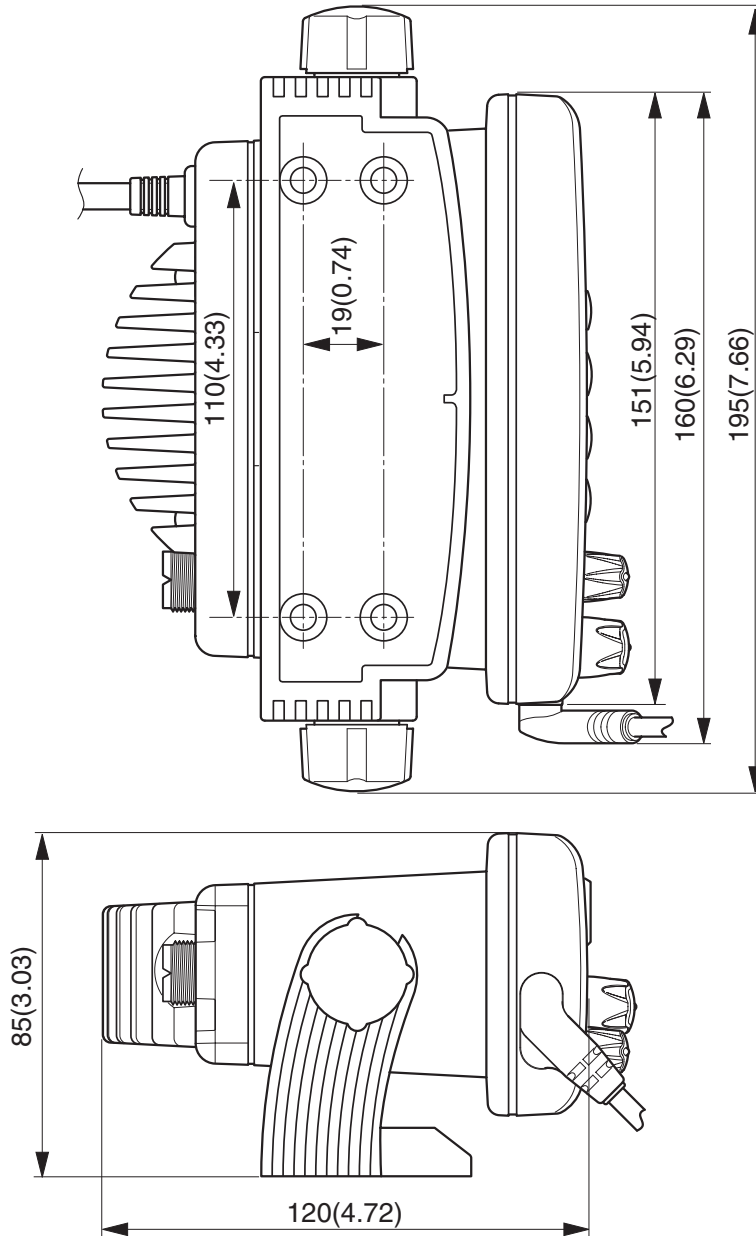


Fig.2-2 OUTLINE AND MOUNTING DIMENSIONS
 All dimensions are shown in (inches) and millimeters

2.4 ELECTRICAL CONNECTIONS

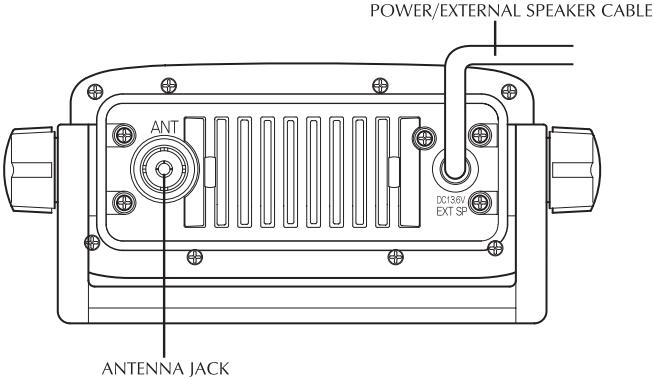


Fig.2-3 REAR VIEW

CAUTION
Do not install this radio on vessels with positive ground battery systems.

2.4.1 DC Power and External Speaker Connections

The power cable comes with external speaker attachments. The power/external speaker cable provided is 6 feet long and plugs into the 4 pin connector cable at the rear panel of the radio. The RED (+) wire with an in-line fuse (10 amps) and the BLACK (-) wire of the 4 pin connector cable are used for connecting the Ray48 to the ship's 12 VDC power system. (Refer to Fig. 2-4)

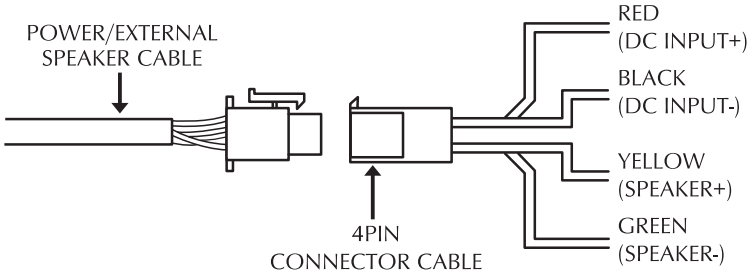


Fig.2-4 POWER/EXTERNAL SPEAKER CABLE AND 4 PIN CONNECTOR CABLE

In most cases the length of the power cable should be adequate enough to reach the DC power source. If additional wire length is required, the cable can be extended by adding more cable as necessary. However, for power cable runs longer than 15 feet, larger wire diameter size should be used to prevent voltage line loss. Fig 2-5 provides recommended wire sizes to use for various cable run distances.

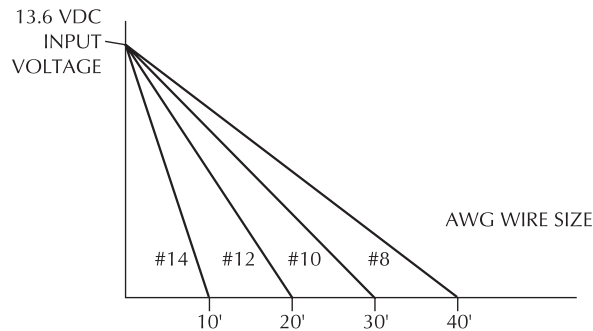


Fig.2-5 POWER CABLE LENGTH

Your Ray48 radio should be connected to the nearest primary source of ship's DC power. A typical source may be a circuit breaker on the power panel or a fuse block near the unit. When connecting to either of these sources, the circuit breaker or other in-line fuse should be rated at 10 amps.

It is recommended that terminal lugs be used to connect the power cable to the DC supply and the lug connections should be both **crimped and soldered**. This is very important in order to insure adequate current draw to the equipment. Intermittent operation may result if an insufficient connection is made to the power source. The connection terminal should be clean, with no sign of corrosion.

The RED (+) wire is connected to the positive terminal of the power source or battery. The BLACK (-) wire is connected to the negative (ground) of the power source or battery. Should the power polarity be inadvertently reversed, the 10 amp. in-line fuse located in the RED (+) conductor will open. Check the input power leads for correct polarity with a VOM, reconnect the leads observing correct polarity, and replace the fuse. Be sure to use the same rate and type of fuse.

2.4.2 External Speaker Connections

The YELLOW (+) wire and GREEN (-) wire are used for connecting the Ray48 to an external speaker (Refer to Fig.2-4).

Three watts of audio output power is provided for an external 4 ohm speaker. A suitable speaker can be purchased from your local marine dealer.

Connect the YELLOW (+) wire and GREEN (-) wire to the speaker observing polarity as it is marked on the speaker. When connected, the external speaker will function simultaneously with the internal speaker.

2.4.3 Antenna Connections

The coaxial cable to your VHF antenna is intended to be connected to the antenna jack on the rear panel using a PL259 VHF type connector. The antenna cable can be cut to length but the overall cable length can be critical to performance. If you are uncertain, contact a professional installer or call our Product Support department. If a longer cable length is required, RG-58 (50 ohm) coaxial cable or equivalent cable may be used for runs up to a maximum of 50 feet. If the distance required is even greater, then we recommend using low loss RG-213 or equivalent cable for the entire run in order to avoid excessive losses in power output.

If the antenna RF connector is likely to be exposed to the marine environment, a protective coating of grease (Dow Corning DC-4 or similar) can be applied to the connector before connecting it to the radio. Any other extensions or adapters in the cable run should also be protected by silicon grease and then wrapped with a waterproofing tape.

2.4.4 Antenna Mounting Suggestions

The best radio in the world is useless without a quality antenna and good location. Mounting the VHF antenna properly is very important because it will directly affect the performance of your VHF radio. A VHF antenna designed for marine vessels should be used.

- Since VHF transmissions are essentially line-of light, mount the antenna where it is free of obstructions to obtain maximum range.
- If you must extend the length of the coaxial cable between the antenna and the radio, use a coaxial cable designed for the least amount of power loss over the entire cable length.
- Keep the coaxial cable between the radio and antenna as short as possible but remember to maintain the recommended 3 feet between the radio and antenna.

Please note that some antennas are supplied with a cable that may not be altered in any way. Please check the instructions supplied with your antenna before cutting or altering the cable.

2.4.5 Grounding

While special grounding is not generally required for VHF radiotelephone installations, it is good marine practice to properly ground all electronic equipment to the ship's ground system. The Ray48 can be connected to ground by attaching a wire to one of the screws on the unit's rear panel and then to the nearest ship's ground connection point. The recommended wire to be used for such grounding is #10 AWG.

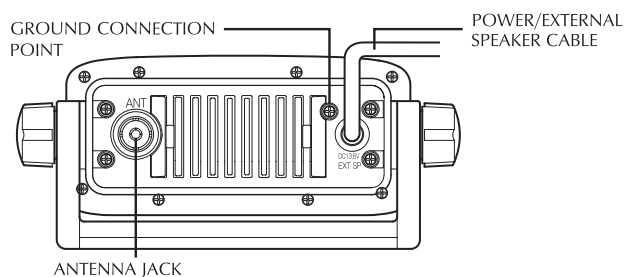


Fig.2-6 TYPICAL GROUNDING METHODS

SECTION 3

OPERATIONS

3.1 INTRODUCTION

Your Ray48 has the capability to transmit and receive on all available US and International Marine VHF radiotelephone channels. There are channels that are FCC approved but may only be used by authorized stations for specific purposes, depending on the type of vessel (commercial or noncommercial). Refer to Table 6-1. This table lists all of the marine VHF channels available in your Ray48 for US and International radiotelephone use. Full familiarization of this table is essential when selecting your channels to insure proper channel usage.

3.2 CONTROLS AND LCD DISPLAY

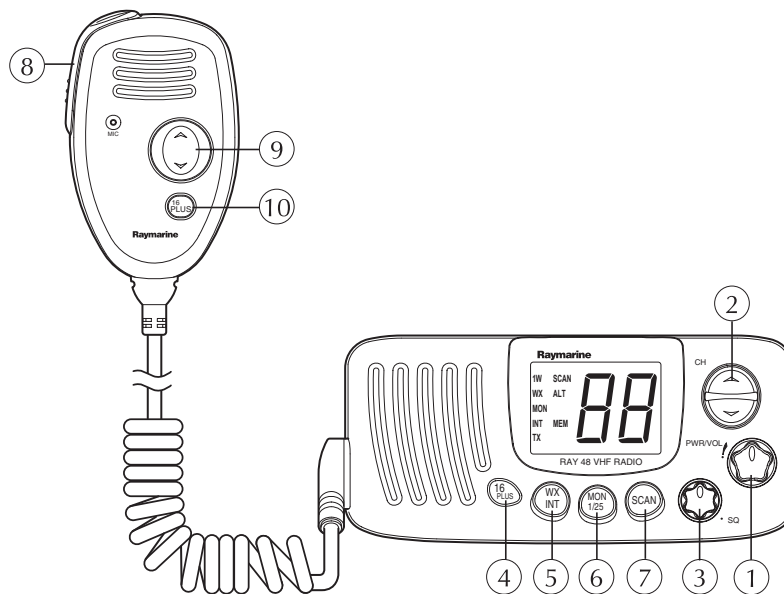


Fig.3-1 LAYOUT OF CONTROLS AND CONNECTORS

3.2.1 Controls

① VOLUME Control (On/Off)

Turns the radio On and Off and controls the Volume of the audio output to the speaker.

② [▲] [▼] Keys

The Up and Down keys are used to move the channel numbers up or down. The channel number can be increased or decreased by one with each key press, or will continue to increase or decrease the number as the key is held.

③ SQUELCH control

Provides an adjustable input signal threshold to eliminate random RF background noise during "no signal" conditions. This control sets the signal-to-noise ratio at which a signal will become audible.

④ [16 PLUS] Key

Used to select channel 16 immediately. This channel has been preset to channel 16 at the factory prior to shipment. Refer to section 3.3.2 for instructions on how to change the 16 PLUS channel. The 16 PLUS key on the microphone has the same functions as the 16 PLUS key on the radio.

⑤ [WX/INT] Key

When pressed once, puts the radio into the weather channel receiving mode. A "WX" will be displayed on the LCD along with the weather channel number (0-9).

When pressed and held for two seconds, the radio toggles between the US and International channel sets. "INT" appears on the display in International mode.

⑥ [MON/1/25] Key

When pressed once, the radio enters the MONITOR mode and "MON" is displayed on the LCD. In this mode, the radio will scan (monitor) 16 PLUS (priority) channel, a selected working channel, and a weather channel for the weather alert tone.

When pressed and held for two seconds, this key toggles the transmitter output power between 1 watt ("1W" is displayed) and 25 watts ("1W" disappears).

⑦ [SCAN] Key

Used to enter All Scan and Memory Scan Modes.

More detailed operation information is available in Section 3.3.4 Scan Modes

⑧ PTT (Push-To-Talk) Switch

When pressed, puts the radio into the transmit mode and "TX" will be displayed on the LCD.

⑨ [▲] [▼] Keys

The Up and Down keys are used to move the channel numbers up or down. The channel number can be increased or decreased by one with each key press, or will continue to increase or decrease the number as the key is held.

⑩ [16 PLUS] Key

Used to select channel 16 immediately. This channel has been preset to channel 16 at the factory prior to shipment. Refer to section 3.3.2 for instructions on how to change the 16 PLUS channel. The 16 PLUS key on the microphone has the same functions as the 16 PLUS key on the radio.

All of the above keys except PTT will produce an audible "beep" when pressed.

3.2.2 LCD Display

The following describes the functional characters on the Ray48's LCD.

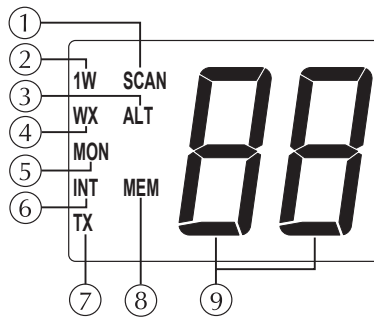


Fig.3-2 LCD DISPLAY

- ① SCAN: Will flash by itself when All-Scan mode is to be initiated or will flash in unison with "MEM" when Memory Scan mode is to be initiated.
- ② 1 W (High/Low Power): Will be displayed when the transmitter circuits are providing 1 Watt of power to the antenna. When the transmitter is supplying 25 Watts to the antenna, the "1 W" indication will be extinguished.
- ③ ALT (Weather Alert): Will blink when a Weather Alert Tone has been detected.
- ④ WX (Weather): Will be displayed when the channel selected to be monitored is a weather channel.
- ⑤ MON (Monitor): Will be displayed when the MON/INT key is pressed. This indicates the radio is in the MONITOR mode.
- ⑥ INT (International/USA): Will be displayed when International channels are programmed for use. "INT" is not displayed when US channels are programmed for use.
- ⑦ TX (Transmit): Will be displayed on the LCD when the Push-To-Talk (PTT) switch is depressed indicating the transmitter circuits are providing a signal to the antenna.
- ⑧ MEM (Memory): Will be displayed when the SCAN key is pressed and held for two seconds, or when the radio is programmed to the MEMORY SCAN mode.
- ⑨ LCD Segments: Will display channel number in use.

3.3 OPERATING PROCEDURES

3.3.1 Turning the Power On

- 1) Rotate the ON/OFF/VOLUME control clockwise to turn the radio on.

NOTE

When the Power is on, the synthesizer automatically programs for the USA channel frequencies and selects the calling channel 16. (Refer to 16 PLUS operation to change this channel.)

Setting the Volume

- 1) Rotate the SQUELCH control slowly counterclockwise. Background noise will be heard.
- 2) Rotate the VOLUME control for the desired volume level.

Setting the Squelch

- 1) Rotate the SQUELCH control slowly clockwise until the background noise ceases.

Setting the Power Output

- 1) Press the "MON/1/25" key for two seconds to toggle between 1 Watt output and 25 Watt output. When "1 W" is displayed, the output power is 1 watt. If "1 W" is extinguished, 25 watts is being output. The choice of power output is dependent upon the distance of transmission and transmitting conditions. In certain US harbors and on certain channels, the FCC requires the power to be limited to 1 watt. On these "required" channels, the radio automatically selects the 1 Watt power output when the channel is selected.

NOTE

Channels 13 and 67 are restricted to 1 Watt operation but may be overridden in emergencies. To obtain 25 Watt output on these channels, while in transmit mode (pressing the PTT switch), press and hold the MON/1/25 key. As long as the MON/1/25 key is held, power output will be 25 Watts. When the key is released, the radio reverts back to 1 Watt as indicated on the LCD.

Selecting the Channel

- 1) To select the appropriate channel, press the [▲] or [▼] channel select keys. Refer to Table 6-1 to select your "working" channel.

To Transmit

- 1) Select the desired mode (INT or USA) by pressing and holding the WX/INT key for two seconds. When "INT" is displayed, International mode is selected. When extinguished, USA mode is active. Then press the Push-To-Talk switch and speak into the microphone using a clear normal voice.
- 2) When the power is initially turned on, press the Push-To-Talk switch, the radio will be ready for transmission on CH 16 or a user selected priority channel (16 PLUS).

As a safety feature, the Ray48 is designed to inhibit transmission if the Push-to-Talk switch is pressed continuously for over five minutes. If this occurs, audible beeps will sound and "TO" (time out) blinks on the LCD until the Push-To-Talk switch is released. After releasing the Push-To-Talk switch, the radio is ready for reception.

NOTE

Initial communication contacts are usually made over channel 16 as all ships and shore stations monitor this channel. Then a shift to a working channel will be necessary.

To Select a Weather Channel

- 1) Press the WX/INT key, then use the Up [▲] or Down [▼] key to select the desired weather channel from 0 to 9. When this mode is selected, the transmitter is always inhibited.
- 2) If a weather alert signal is received on your selected WX channel (when in the Monitor Mode) there is a five-second audible alarm generated. To cancel the audible alarm, press any key.

3.3.2 The 16 PLUS (priority) Channel

The 16 PLUS channel has been preset to channel 16 prior to shipment from the factory, but the 16 PLUS channel can be changed to another number, with the exception of all weather channels.

- 1) Press the Up [▲] or Down [▼] key to select the desired channel. Then press and hold the 16 PLUS key for three seconds. An audible beep tone will confirm that the selected channel is stored in memory as the 16 PLUS channel.
- 2) To reselect channel 16 as the 16 PLUS channel, repeat step 1 for channel 16.

3.3.3 Channel Memory

The Ray48 can store into memory all U.S. or International channels. The stored channels will be scanned during Memory Scan mode.

- 1) Channel Memory: To put a channel into memory, select the channel to be stored with the Up or Down arrows. Push and hold the "SCAN" key for approximately two seconds until a "beep" is heard and "MEM" is displayed on the LCD. This procedure can be repeated for all U.S. or International channels.
- 2) Memory Clear: To clear a channel from memory, select the channel to be cleared with the Up or Down arrows. Push and hold the "SCAN" key for approximately two seconds until a "beep" is heard and "MEM" disappears from the LCD.

3.3.4 Scan Modes

The Ray48 is equipped with two types of scan options, All-Scan and Memory Scan. How these options are accessed is dependent upon whether there are any channels stored in memory.

- 1) All-Scan mode
If no channels are stored in memory, when the SCAN key is pressed once, "SCAN" will begin to flash on the LCD. In three seconds, if no other keys are pressed, the radio will begin scanning all channels (except weather channels) as long as no signal is received. If a signal is received, the scan will stop and monitor the receiving channel. If the signal is lost for five seconds, the radio will resume scanning. If the scan has stopped on a received signal, you may resume scanning by pressing the SCAN key. To cancel the scan mode, press the SCAN key once while the radio is scanning.

2) Memory Scan Mode

If one or more channels are stored in memory, when the SCAN key is pressed, "SCAN" and "MEM" will begin to flash simultaneously on the LCD. If no other key is pressed, the radio will begin scanning all channels currently in memory in three seconds. As with All-Scan, if a signal is received, the scan will stop on the receiving channel until the signal is lost for five seconds or the SCAN key is pressed. To cancel memory scan, press the SCAN key while the radio is scanning.

If you have one or more channels in memory and want to initiate All-Scan, perform the following:

Press the SCAN key. "SCAN" and "MEM" will flash on the LCD. Press the SCAN key again within three seconds and "MEM" will disappear from the LCD leaving only "SCAN" flashing. All-Scan will begin in three seconds if no other key is pressed.

3.3.5 Master Reset

To perform a master reset, press and hold the 16 PLUS key while turning the unit on. This feature clears all channels from memory and programs the 16 PLUS feature back to channel 16.

3.3.6 Monitor Mode

Before entering the Monitor Mode you must first select the WX channel you wish to monitor for the weather alert tone. Next, you must also select a working channel to be monitored for traffic. (Refer to section 3.3 for instruction on channel section).

- 1) Press WX/INT, then scroll to the desired weather channel with the arrow keys.
- 2) Press the 16 PLUS key to exit the weather band and return to normal mode.
- 3) Use the arrow keys to select the desired working channel.
- 4) Press the MON/1/25 key to begin monitor mode. Press the MON/1/25 key again to cancel Monitor Mode.

As an example, let's say we have selected channel 68 as our working channel, WX2 as our weather channel and the 16 PLUS key is programmed for channel 16.

When MON/1/25 is pressed, the radio begins to scan Priority Channel 16, the working channel 68 and weather channel WX2.

Working Channel

If a signal is received on CH68, the scan will stop on CH68, but continue to monitor 16 PLUS and the selected weather channel every five seconds.

16 PLUS (priority) Channel

If while scanning, a signal is received on the designated 16 PLUS channel, the scanning will stop on 16 PLUS as long as the signal is being received. If the signal ceases for more than five seconds, the scanning will continue.

Weather Channel

Until a weather alert tone signal is received on WX2, the scan will stop on WX2 briefly, but will not give any audio output. When a weather alert tone (1050Hz) is received, the monitor will stop and an audible alarm will sound. When the audio alert ends in five seconds, the emergency weather broadcast will be heard. To silence the alarm, simply push any key.

SECTION 4

TECHNICAL DESCRIPTION

4.1 GENERAL

The Ray48 can be considered as consisting of two major sections. They are:

- The Control Circuitry (considering of the front panel controls, the LCD display, control CPU)
- The Transmitter/Receiver/PLL circuits

4.2 THE CONTROL SECTION

The heart of the control section is the CPU IC201, located on the Front PCB.

The CPU controls all of the following items:

- Controls the Squelch circuit by detecting a busy signal from the second IF circuit IC5.
- Generates a beep tone when a key is activated on the keyboard.
- Mutes the transmitter modulation circuit when receiving.
- Controls the output power of the transmitter High/Low.
- Controls the dividing ratio N of the PLL circuit.
- Switches On/Off the transmitter power.
- Mutes AF audio.
- Detects a weather alert signal (when in Monitor Mode).
- Controls the LCD display.

4.3 THE TRANSMITTER/RECEIVER/PLL SECTIONS

In reading through the following circuit descriptions, it may be helpful to refer to Figure 4-1 Block Diagram of the TX/RX/PLL circuits.

4.3.1 PLL (Phase Lock Loop Circuit)

The PLL circuit is the frequency synthesizer in the Ray48.

The reference frequency of 12.8 MHz is provided by crystal XTL1 and IC3. IC3 contains the reference oscillator (12.8 MHz) circuit, the phase comparator, the program counter and the phase detector. The 12.8 MHz reference signal is divided by 512 in the program counter in IC3 to obtain a 25 KHz reference signal. The dividing ratio is determined by CPU IC201. The VCO output from oscillator Q4 is amplified by buffer amplifier Q3, and returned to IC3 and is divided by the dividing ratio N to obtain a 25 KHz signal. N for 1N in IC3 is determined by CPU IC201. Both of these 25 KHz signals are fed into the phase comparator circuit of IC3.

The phase detected signal, obtained by comparing the two 25 KHz signals the same phase. When this condition is met, the PLL circuit is locked. If the two signals have a large phase difference, the PLL is unlocked. In this condition, the unlocked signal is fed to CPU IC201 from IC3 and the transmitter is compelled to stop.

The VCO output from Q4 is fed to the TX amplifier Q2 and the first RX mixer Q19 through buffer amplifier Q3.

4.3.2 Transmitter Circuit

A signal from the microphone is fed to a pre-emphasis operations amplifier IC3, and modulates VCO (Q4) through active LPF IC2.

The VCO output signal from Q4 is sent to the RF power amplifiers IC1, Q1 and Q2 through buffer amplifier Q3. The RF signal from IC1 is fed to the antenna through a low pass filter.

The DC voltage correlative to the RF output is detected by D2 and Q9, amplified by Q24 and fed to IC1. The output power voltage from IC1 controls the RF power to keep RF output at a constant level.

4.3.3 Receiver Circuit

1) RF Circuit

The signal from the antenna passes through the single tuned band pass filter, and is amplified by RF amplifier Q17, and is fed into a triple tuned band pass filter. The signal is then mixed by Q19 (first mixer) and produces the first IF signal of 21.6 MHz. This signal is sent to a crystal filter (21.6 MHz) and first IF amplifier Q20, mixed by IC4, the second mixer, and becomes an audio signal after detection.

2) IF Circuit

The output of the first IF amplifier Q20 is fed into IC4. IC4 contains the second mixer, second local oscillator, 455 KHz amplifier, quadrature detector and DC switching amplifier.

A 455 KHz ceramic filter is installed between pins 3 and 5 of IC4 to examine the selectivity of this unit.

The detector output is separated into audio and noise components by an RC filter. The noise component is fed back to the noise amplifier section of IC4. Its output is rectified by a diode in IC4 and then fed to the switching amplifier in IC4.

3) AF Circuit

The signal from IC4 is amplified by IC5 to drive the speaker while the receiver is in the squelched condition. Muting control of IC5 is carried out by the CPU IC201.

4) Weather Alert Tone Detecting Circuit

If a weather alert tone is included in the AF signal from IC4 while receiving the weather service broadcast, IC6 detects it and notifies an alert condition to CPU IC201.

4.4 SPECIFICATIONS

4.4.1 Transmitter

Channels	53 US/International
Frequency Stability	± 10 PPM ($\pm 0.001\%$) (-20°C to $+50^{\circ}\text{C}$)
Frequency Range	156.025 to 157.425 MHz
Channel Spacing	25 KHz Increments
Power Output	25 Watts switchable to 1 Watt into 50 Ohms at 13.6 Vdc
modulation	Frequency modulated 16F3 (± 4.5 KHz at 1000 Hz)
Modulation Audio Response	Shall not vary $+1/-3$ dB from true 6 dB pre-emphasis from 300 to 2500 Hz, reference 1000 Hz. Audio frequencies 3-20 KHz shall be attenuated (at 1KHz by 60 log f/3 dB. Above 20 KHz by 50 dB)
FM Hum & Noise Level	Greater than -40 dB below audio
Audio distortion	Less than 10% at 1 KHz for ± 3 KHz deviation
Spurious & harmonic Emissions	Attenuated at least $43+10 \log P_o$ (below rated radiated carrier power) per FCC Rules Parts 2 & 80
Antenna Impedance	50 Ohms
Transmitter Protection	Shall survive open or short circuit of antenna system without damage (10 min. test)

4.4.2 Receiver

Channels	93 (includes 10 weather channels)
Frequency Range	156.025 to 163.275 MHz in 25 KHz increments
Frequency Stability	± 10 PPM ($\pm 0.001\%$) from -20°C to $+50^{\circ}\text{C}$
Usable Sensitivity	0.3 μV for 12 dB (SINAD)
Squelch Sensitivity Threshold	0.2 μV or better 1.0 μV full squelch
Adjacent Chl Rejection	Greater than 65 dB
Spurious Image Rejection	Greater than 65 dB
Intermodulation Rejection	Greater than 65 dB
Audio Output	3 Watt or more at 10% or less distortion into 4 Ohm load
Hum & Noise in Audio	Less than -40 dB

4.4.3 Operating Requirement

Input Voltage	13.6 Vdc \pm 15% (11.6 to 15.6 Vdc)
Current Required Transmit	Less than 5.8 amp at 25 Watts
	Less than 1.5 amp at 1 Watt
Operating Temperature	-20°C to +50°C
Duty Cycle	Continuous, 80% receive, 20% transmit (max 10 min. @25°C)
Humidity	100% at 50°C for 8 hours

4.4.4 Radio Dimensions

Height	70mm
Width	160mm
Depth	120mm
Weight	900g (1.98 lbs)

4.5 BLOCK DIAGRAM

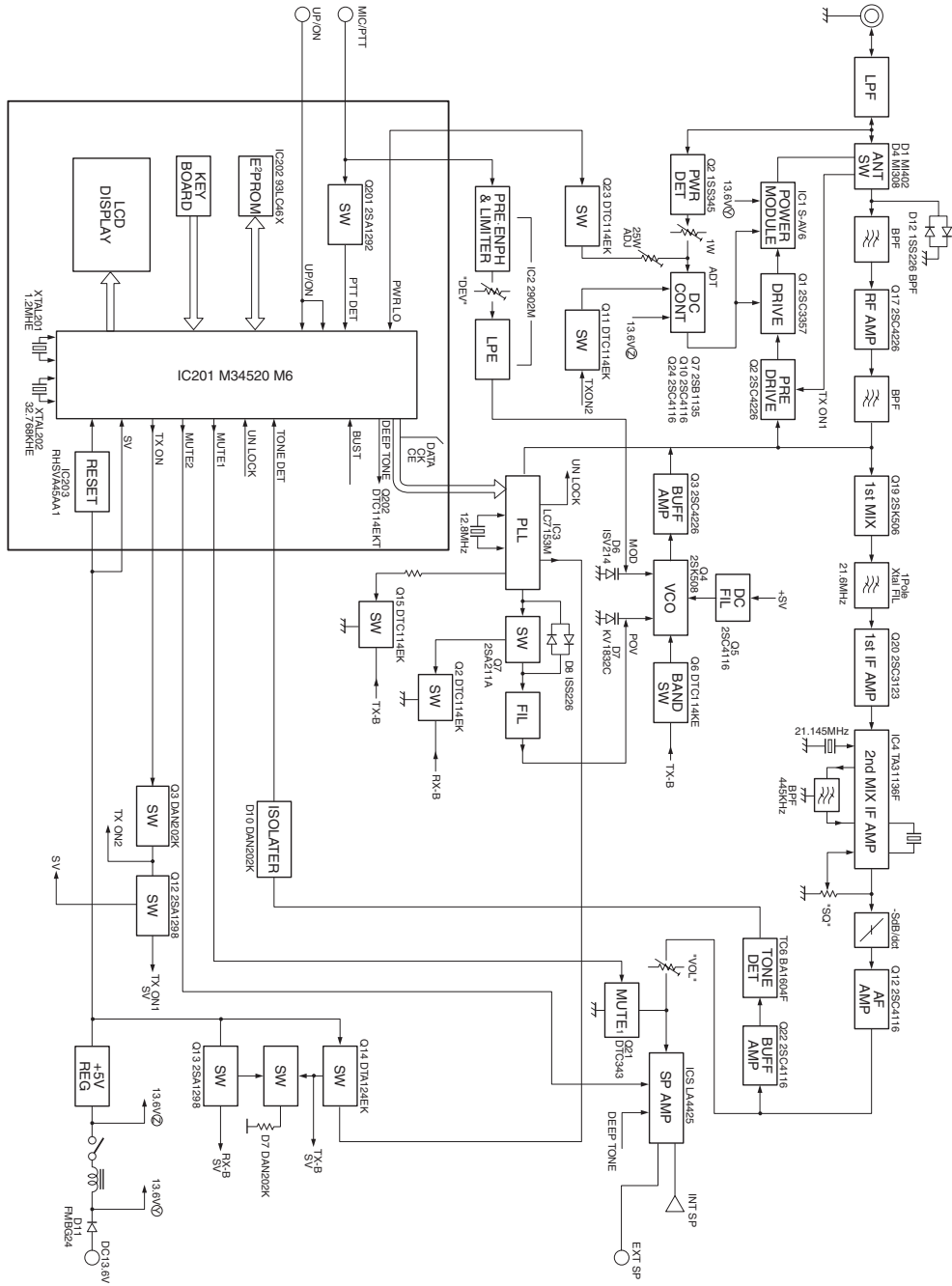
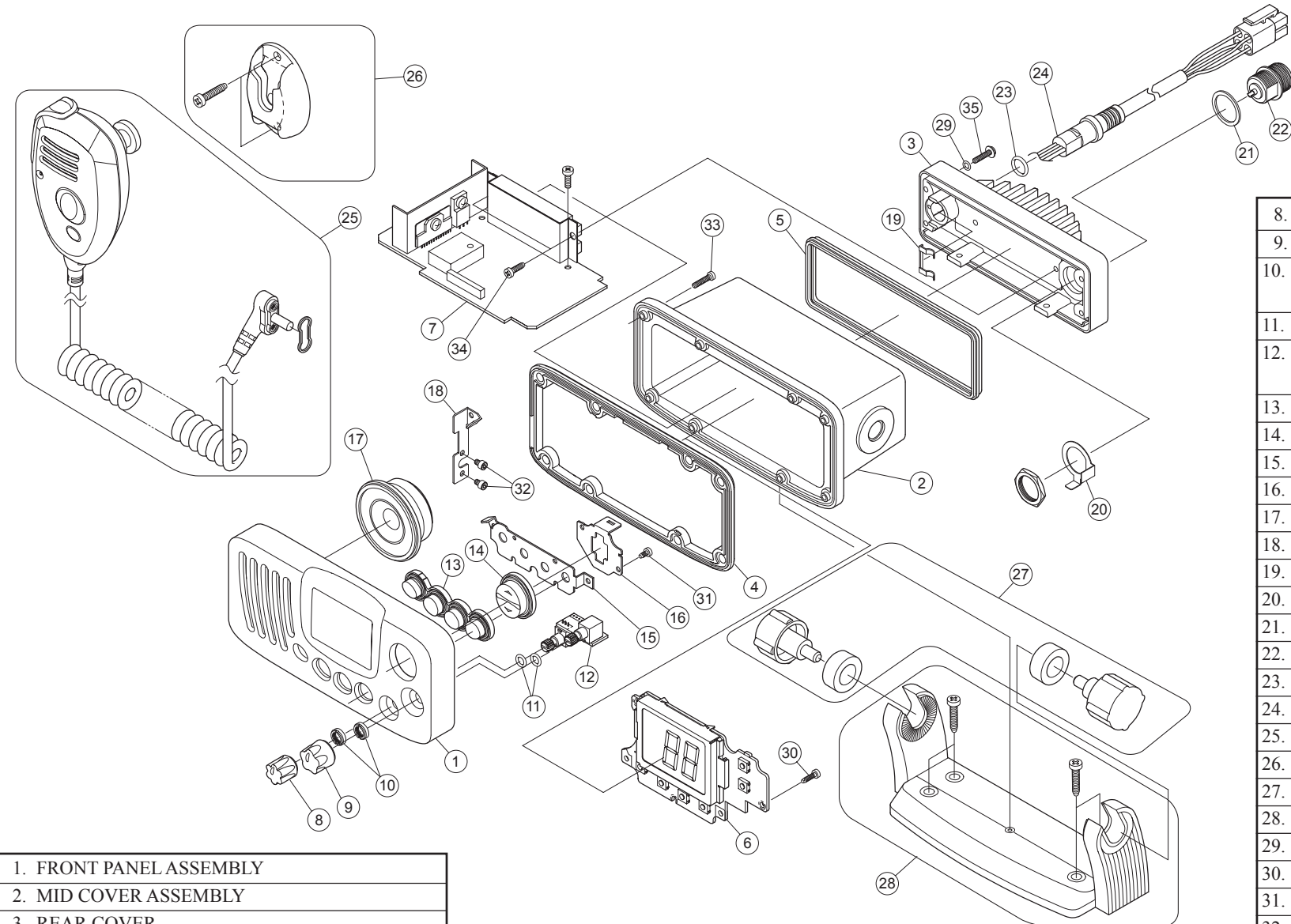


Fig. 4-1 Ray/88 Block Diagram

4.6 Ray48 ASSEMBLY DRAWING



1. FRONT PANEL ASSEMBLY
2. MID COVER ASSEMBLY
3. REAR COVER
4. FRONT GASKET
5. REAR GASKET
6. FRONT PCB ASSEMBLY
7. MAIN PCB ASSEMBLY

8. KNOB SQUELCH
9. KNOB POWER/VOLUME
10. POWER/VOLUME/SQUELCH POT NUT
11. O-RING (m6)
12. POWER/VOLUME/SQUELCH PCB ASSEMBLY
13. KEY MAIN
14. KEY CH
15. HOLDER - KEY MAIN
16. HOLDER - KEY CH
17. INTERNAL SPEAKER
18. HOLDER SPEAKER
19. PLATE SPRING
20. TERMINAL GROUND
21. GASKET (ANT) 20mm
22. ANTENNA RF CONNECT
23. O-RING (m9)
24. POWER CORD ASSEMBLY
25. MICROPHONE ASSEMBLY
26. MIC HANGER KIT
27. YOKE KNOB KIT
28. MOUNTING YOKE KIT
29. O-RING (m2.6)
30. SCREW m2.6X8
31. SCREW m2.6X5
32. SCREW HEXAGON M2.6
33. SCREW M2.6X12
34. SCREW M3X8
35. SCREW M2.6X12TP
36. SCREW M5X20TP

SECTION 5

MAINTENANCE

5.1 GENERAL

The Ray48 is designed to provide long periods of trouble-free operation. It is recognized, however, that environmental and other factors may result in a need for occasional service.

5.1.1 How to contact Raymarine

Technical Support: 1-800-539-5539 ext. 2444 or 603-881-5200 ext. 2444

You may reach our Technical Support Department Monday to Friday 4:00 AM to 6:00 PM Eastern Time. Our Technical Support Specialists are available to answer installation, operation, and trouble-shooting questions about your Raymarine unit.

Accessories and Parts: 1-800-539-5539 ext. 2333 or 603-881-5200 ext. 2333

Many Raymarine accessory items and parts are available through your authorized Raymarine dealer. However if you are in need of an item not available through your retailer feel free to contact our Customer Service department Monday to Friday 8:15 AM to 5:00 PM Eastern Standard Time. If you are uncertain about what item to choose for your Raymarine unit please contact our Technical Support Department Prior to placing your order at 603-881-5200 ext. 2065.

Product Repair and Service

In the unlikely event your Raymarine unit should develop a problem please contact the Raymarine dealer from where the unit was purchased. Your Raymarine dealer is best equipped to handle your service needs.

Service may also be obtained by returning your unit to Raymarine's Product Repair Center at the address below.

Raymarine, Inc.
Product Repair Center
22 Cotton Road, Unit D
Nashua, NH 03063-4219

On the Internet

Visit the Raymarine World Wide Web site for the latest information on Raymarine electronic equipment and systems at:
www.raymarine.com

Navigate to the **Customer Support** Page, which provides links for:

- Finding Factory Service locations and Authorized Dealers near you
- Registering your Raymarine products
- Accessing handbooks in Adobe Acrobat format
- Downloading RayTech software updates
- Accessing the Raymarine solution database

Clicking the Find Answers link routes you to our solution database. Search questions and answers by product, category, keywords, or phrases. If the answer you are seeking is not available, click the **Ask Raymarine** tab to submit your own question to our technical support staff, who reply to you by e-mail.

SECTION 6

Ray48 MARINE CHANNELS FREQUENCY TABLES

6.1 Ray48 MARINE CHANNELS AND THEIR USAGE

CAUTION

The transmitter of the Ray48 is disabled when channel 15, 75, 76 or WX0-WX9 is displayed.

U.S. VHF Marine Radio Channels and Frequencies

CH No.	Frequency			Use
	XMIT	RCV	Single	
01A	--	156.050	x	Port Operations and Commercial, VTS. Available only in New Orleans/Lower Mississippi area. ¹
02	--	156.100	x	Port Operations
03	--	156.150	x	Port Operations
04	--	156.200	x	Port Operations
05A	156.250	156.250	x	Port Operations or VTS in the Houston, New Orleans and Seattle areas.
06	156.300	156.300	x	Intership Safety
07A	156.350	156.350	x	Commercial
08	156.400	156.400	x	Commercial (Intership only)
09	156.450	156.450	x	Boater Calling. Commercial and Non-Commercial
10	156.500	156.500	x	Commercial
11	156.550	156.550	x	Commercial. VTS in selected areas.
12	156.600	156.600	x	Port Operations. VTS in selected areas.
13	156.650	156.650	x	Intership Navigation Safety (Bridge-to-bridge). Ships >20 meters in length maintain a listening watch on this channel in US waters. ^{2,4}
14	156.700	156.700	x	Port Operations. VTS in selected areas.
15	--	156.750	x	Environmental (Receive only). Used by Class 'C' EPIRBs
16	156.800	156.800	x	International Distress, Safety and Calling. Ships required to carry radio, USCG, and most coast stations maintain a listening watch on this channel. ³
17	156.850	156.850	x	State Control
18A	156.900	156.900	x	Commercial
19A	156.950	156.950	x	Commercial
20A	157.000	157.000	x	Port Operations
21A	157.050	157.050	x	U.S. Coast Guard only
22A	157.100	157.100	x	Coast Guard Liaison and Maritime Safety Information Broadcasts. Broadcasts announced on channel 16.
23A	157.150	157.150	x	U.S. Coast Guard only
24	157.200	161.800		Public Correspondence (Marine Operator)
25	157.250	161.850		Public Correspondence (Marine Operator)
26	157.300	161.900		Public Correspondence (Marine Operator)
27	157.350	161.950		Public Correspondence (Marine Operator)
28	157.400	162.000		Public Correspondence (Marine Operator)
60	156.025	156.025	x	Port Operations
61	156.075	156.075	x	Port Operations
62	156.125	156.125	x	Port Operations
63A	156.175	156.175	x	Port Operations and Commercial, VTS. Available only in New Orleans/Lower Mississippi area.
64	156.225	156.225	x	Port Operations
65A	156.275	156.275	x	Port Operations

Table 6-1

CH No.	Frequency			Use
	XMIT	RCV	Single	
66A	156.325	156.325	x	Port Operations
67	156.375	156.375	x	Commercial. Used for Bridge-to-bridge communications in lower Mississippi River. Intership only. ⁴
68	156.425	156.425	x	Non-Commercial
69	156.475	156.475	x	Non-Commercial
70	156.525	156.525	x	Digital Selective Calling (voice communications not allowed)
71	156.575	156.575	x	Non-Commercial
72	156.625	156.625	x	Non-Commercial (Intership only)
73	156.675	156.675	x	Port Operations
74	156.725	156.725	x	Port Operations
75	- -	156.775	x	CH 16 Guard Band. RX only.
76	- -	156.825	x	CH 16 Guard Band. RX only.
77	156.875	156.875	x	Port Operations (Intership only)
78A	156.925	156.925	x	Non-Commercial
79A	156.975	156.975	x	Commercial. Non-Commercial in Great Lakes only.
80A	157.025	157.025	x	Commercial. Non-Commercial in Great Lakes only.
81A	157.075	157.075	x	U.S. Government only - Environmental protection operations.
82A	157.125	157.125	x	U.S. Government only
83A	157.175	157.175	x	U.S. Government only
84	157.225	161.825		Public Correspondence (Marine Operator)
85	157.275	161.875		Public Correspondence (Marine Operator)
86	157.325	161.925		Public Correspondence (Marine Operator)
87	157.375	161.975		Public Correspondence (Marine Operator)
88A	157.425	157.425	x	Commercial, Intership only

Table 6-1 (Continued)

Boaters should normally use channels listed as Non-Commercial.

NOTE

1. The letter "A" following a channel number indicates simplex use of the ship station transmit side of an international duplex channel. Operations are different from that of international operations on that channel.
2. Channels 13 should be used to contact a ship when there is danger of collision. All ships of length 20 meters or greater are required to guard VHF channel 13, in addition to VHF channel 16, when operating within U.S. territorial waters.
3. Channel 16 is used for calling other stations or for distress alerting.
4. Channel 13 and 67 are 1 Watt initially.
User can override to high power (25 Watts) via front panel controls.
5. The transmitter is automatically disabled when channels 1, 2, 3 and 4 are selected.
6. Channels 75 and 76 are receive-only. Transmission on these channels has been disabled as a precaution to avoid harmful interference to channel 16.

CAUTION

Operation on channels not designated for use by your classification of craft or on International Channels within the US territorial waters is a violation of FCC Rules and Regulations and may result in severe penalties.

U.S. NOAA Weather Radio Frequencies

Weather Channel	Frequency in MHz
WX0	163.275
WX1	162.550
WX2	162.400
WX3	162.475
WX4	162.425
WX5	162.450
WX6	162.500
WX7	162.525
WX8	161.650
WX9	161.775

International VHF Marine Radio Channels & Frequencies

CH No.	Frequency			Use
	XMIT	RCV	Single	
01	156.050	160.650		Public Correspondence, Port Operations and Ship Movement
02	156.100	160.700		Public Correspondence, Port Operations and Ship Movement
03	156.150	160.750		Public Correspondence, Port Operations and Ship Movement
04	156.200	160.800		Public Correspondence, Port Operations and Ship Movement
05	156.250	160.850		Public Correspondence, Port Operations and Ship Movement
06	156.300	156.300	x	Intership ¹
07	156.350	160.950		Public Correspondence, Port Operations and Ship Movement
08	156.400	156.400	x	Intership
09	156.450	156.450	x	Intership, Port Operations and Ship Movement
10	156.500	156.500	x	Intership, Port Operations and Ship Movement ²
11	156.550	156.550	x	Port Operations and Ship Movement
12	156.600	156.600	x	Port Operations and Ship Movement
13	156.650	156.650	x	Intership Safety, Port Operations and Ship Movement ³
14	156.700	156.700	x	Port Operations and Ship Movement
15	- -	156.750	x	Receive Only
16	156.800	156.800	x	Distress, Safety and Calling
17	156.850	156.850	x	Intership and On-board Communications at 1W only ⁴
18	156.900	161.500		Public Correspondence
19	156.950	161.550		Public Correspondence, Port Operations and Ship Movement
20	157.000	161.600		Public Correspondence, Port Operations and Ship Movement
21	157.050	161.650		Public Correspondence, Port Operations and Ship Movement
22	157.100	161.700		Public Correspondence, Port Operations and Ship Movement
23	157.150	161.750		Public Correspondence, Port Operations and Ship Movement
24	157.200	161.800		Public Correspondence, Port Operations and Ship Movement
25	157.250	161.850		Public Correspondence, Port Operations and Ship Movement
26	157.300	161.900		Public Correspondence, Port Operations and Ship Movement
27	157.350	161.950		Public Correspondence, Port Operations and Ship Movement
28	157.400	162.000		Public Correspondence, Port Operations and Ship Movement
60	156.025	160.625		Public Correspondence, Port Operations and Ship Movement
61	156.075	160.675		Public Correspondence, Port Operations and Ship Movement
62	156.125	160.725		Public Correspondence, Port Operations and Ship Movement
63	156.175	160.775		Public Correspondence, Port Operations and Ship Movement
64	156.225	160.825		Public Correspondence, Port Operations and Ship Movement
65	156.275	160.875		Public Correspondence, Port Operations and Ship Movement
66	156.325	160.925		Public Correspondence, Port Operations and Ship Movement
67	156.375	156.375	x	Intership, Port Operations and Ship Movement
68	156.425	156.425	x	Port Operations and Ship Movement
69	156.475	156.475	x	Port Operations and Ship Movement

Table 6-1 (Continued)

CH No.	Frequency			Use
	XMIT	RCV	Single	
70	--	156.525	x	Digital Selective Calling for Distress and Safety ⁵
71	156.575	156.575	x	Port Operations and Ship Movement
72	156.625	156.625	x	Intership
73	156.675	156.675	x	Intership ²
74	156.725	156.725	x	Port Operations and Ship Movement
75	--	156.775	x	See Note 6
76	--	156.825	x	See Note 6
77	156.875	156.875	x	Intership
78	156.925	161.525		Public Correspondence, Port Operations and Ship Movement
79	156.975	161.575		Public Correspondence, Port Operations and Ship Movement
80	157.025	161.625		Public Correspondence, Port Operations and Ship Movement
81	157.075	161.675		Public Correspondence, Port Operations and Ship Movement
82	157.125	161.725		Public Correspondence, Port Operations and Ship Movement
83	157.175	161.775		Public Correspondence, Port Operations and Ship Movement
84	157.225	161.825		Public Correspondence, Port Operations and Ship Movement
85	157.275	161.875		Public Correspondence, Port Operations and Ship Movement
86	157.325	161.925		Public Correspondence, Port Operations and Ship Movement
87	157.375	161.975		Port Operations and Ship Movement
88	157.425	162.025		Port Operations and Ship Movement

Table 6-1 (Continued)

Intership channels are for communications between ship stations.

Intership communications should be restricted to Channels 6, 8, 72 and 77.

If these are not available, the other channels marked for Intership may be used.

Channels 10, 67 and 73 should be avoided within VHF range of coastal areas in Europe and Canada.

NOTES

- 1. Channel 06 may also be used for communications between ship stations and aircraft engaged in coordinated search and rescue operations. Ship stations should avoid harmful interference to such communications on channel 06 as well as to communications between aircraft stations, ice breakers and assisted ships during ice seasons.**
- 2. Channels 10 or 73 (depending on location) are also used for the broadcast of Marine Safety Information by the Maritime and Coast Guard Agency in the UK only.**
- 3. Channel 13 is designated for use on a worldwide basis as a navigation safety communication channel, primarily for intership navigation safety communications.**
- 4. Channel 17 may also be used for on-board communications provided the effective radiated power does not exceed 1 Watt.**
- 5. Channel 70 is to be used exclusively for digital selective calling (DSC) for distress and safety.**
- 6. Channels 75 and 76 are receive-only. Transmission on these channels has been disabled as a precaution to avoid harmful interference to Channel 16.**

CAUTION

Operation on channels not designated for use by your classification of craft or on International Channels within the US territorial waters is a violation of FCC Rules and Regulations and may result in severe penalties.

SECTION 7

APPENDIX

7.1 VHF MARINE CHANNEL USAGE GUIDE AND LICENSING REQUIREMENTS

Marine VHF radio users in the US must comply with all applicable FCC rules and regulations, some of which are described here. This information was current at the time this book was printed. Up-to-date information, including licensing requirements, can be obtained on the FCC website at: www.fcc.gov/wtb/marine.

REMEMBER:

- Maintain a radio watch on Channel 16. Channel 16 is used for distress and safety purposes only.
- Your VHF transceiver has a high low power switch. Use low power whenever feasible. Unnecessary high-power operations can interfere with other important communications.
- Always use your radio call sign at the beginning and end of each transmission.
- Be sure only qualified persons operate your radio. You are responsible for control of your radio. Know the rules.
- Limit calls to other vessels to 30 seconds. If you receive no reply, wait 2 minutes; then try again. Keep communications brief and avoid chit-chat.
- Never transmit false distress messages, and never use profanity on the air.

OTHER REMINDERS:

- You can obtain a station license and call sign by completing FCC Form 605, which is available on-line at www.fcc.gov/wtb/marine.

You need a radio operator license to operate a VHF Marine Radio only if you plan to dock in a foreign port or leave a foreign port to dock in a U.S. port.

- Your radio license is not transferable. If you sell your boat, request the FCC to cancel your station license.

If you replace your radio, you do not need to change your license unless the new radio operates on another frequency band. If you install equipment to operate on another frequency band, apply for modification of your license.

- If you carry more than six passengers for hire, your vessel must be certified as a passenger-carrying vessel by the FCC and the Coast Guard.

Licensing Requirements for Hand Held Portable VHF Marine Transceivers 10 Watts Power or Less

All transceivers, hand-helds included, operated in the Maritime Radio Services are required to be operated under an appropriate maritime station license. Operation of hand held VHF Marine transceivers without proper station license can lead to fines and/or administrative sanctions issued against its user and/or owner.

VHF Marine hand held transceivers can be operated and licensed as follows:

- a) Associated Ship Unit: A hand held VHF Marine transceiver can be operated under an existing valid ship station license under the following conditions only:
 - i) Except for safety purposes, the hand held transceivers must be used only to communicate with the ship station with which it is associated. Such associated ship units MAY NOT be operated from shore.
 - ii) The transmitting power is limited to ONE WATT only.
 - iii) The hand held transceiver must be identified by the call sign of the ship station along with its associated unit designator.
- b) Portable Ship Station: The Commission may grant a station license permitting operation of a portable ship station aboard different vessels of the United States. Each application for a portable ship station license must include a showing that:
 - i) The station will be operated aboard vessel.
 - ii) A station license for portable equipment is necessary to eliminate separate applications to operate a ship station aboard different vessels.
- c) Marine Utility Station: A utility station in the maritime mobile service consists of one or more hand held transceiver units licensed under a single authorization. Each unit is capable of operating while being hand carried by an individual. There are two types of stations authorized:
 - i) Marine Utility Coast - when transmitters are located on land; may communicate directly to vessel only.
 - ii) Marine Utility Coast/Ship - transmitters from land may communicate with vessels or when aboard a vessel, may communicate with other vessels or coast stations.

NOTE: A Marine Utility Ship license will not be authorized.

The station operates under the rules applicable to a private coast station when the unit(s) are on land and under the rules applicable to a ship station when the unit(s) are aboard a vessel.

USAGE GUIDE



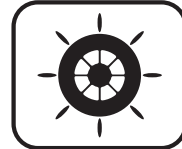
Emergency



Calling



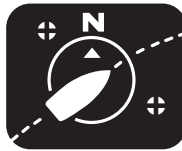
Monitoring



Intership Safety



U.S. Coast Guard



Navigation



Port Operation



Noncommercial



Commercial



Marine Operator



State Control



Environmental



Weather



Emergency

Channel 16

If:

- Your ship is **sinking, or on fire**
- Someone has been lost overboard
- There exists grave and imminent danger

Use this distress procedure:

- Select Channel 16
- Say "Mayday, Mayday, Mayday."
- Give call sign and boat name
- Give location of boat
- Describe emergency
- If no answer, repeat; then try another channel

Caution

Every ship at sea is to obliged to give absolute priority to radio communications relating to ships in distress - it is vital that false distress calls or messages not be broadcast.



Calling

Channel 16 & Working Channel

- If - you wish to establish communications with another station
- And - you know which working channel the station is monitoring
- Then - initiate the call directly on that working channel
- If - you wish to establish communications with another station
- And - you do not know what working channel the station may be monitoring
- Then - initiate the call on channel 16. After contact is made switch to a working channel.

NOTE: Due to congestion on channel 16 caused by frequent hailing of other vessels, the FCC has approved channel 9 as a second hailing channel.

Avoid excessive calling and radio checks

Always monitor before transmitting

Never interrupt emergency communications



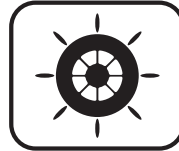
Monitoring

Channel 16 & Working Channel

When - your VHF station is turned on and it is not being used to exchange communications

You Must - monitor channel 16

As an operating convenience, many stations employ a second receiver so that they can monitor a working channel and channel 16 simultaneously.



Intership Safety

Channel: 6

Vessels: Any

Use: Communicating navigational and weather warnings to other ships

Communicating with U.S. Coast Guard stations or other vessels during search and rescue operations

Between: Ship-to-ship only

Comments: Do not use for routine communications. This is a safety channel.



U.S. Coast Guard

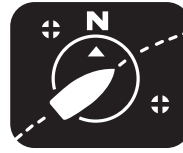
Channel: 22

Vessels: Any

Use: Working channel for exchange of communications with stations of the U.S. Coast Guard.

Between: Ship to U.S. Coast Guard ship, coast to aircraft stations

Comments: U.S. Coast Guard does not regularly monitor this channel. Establish contact on channel 16 and shift to channel 22 as directed.



Navigation

Channels: 13

Vessels: Any

Use: Safety Communications pertaining to the maneuvering of vessels or the directing of vessel movements

Ship-to ship and secondarily ship-to-coast

This is commonly called the Bridge-to-Bridge channel. Large vessels and towboats depend on this channel for their safe navigation. Railway or highway bridges which open for ship navigation often operate on this channel.

Bridge-to-Bridge stations must reduce power to one watt for routine operations.



Port Operations

Channels: 5, 12, 14, 20, 65, 66, 73, 74 [77]

Vessels: Any

Use: Messages relating to the operational handling, movement and safety of vessels in or near ports, locks and waterways.

Between: Ship-to ship or ship-to-coast

Comments: Channel 77 is limited to communications to and from commercial pilots concerning the movement and docking of vessels.

Note: Channels 11, 12, 13 and 14 are used for vessels traffic service on the Great Lakes, St. Lawrence Seaway and designated major ports.



Non commercial (Boat Operations)

Channels: 19, 68, 69, 71, 72, 78

Vessels: Recreational boats and any others not used primarily for commercial transport.

Use: Communications pertaining to the needs of the vessel (i.e., fishing, rendezvous, maneuvers, berthing, scheduling of repairs, provisioning, etc.)

Between: Ship-to-ship or ship to limited coast stations

Comments: Channel 72 may not be used for ship to coast communications. Channel 9 is shared with Commercial users.

If you regularly monitor one of these channels with a second receiver, please notify frequently-called stations of this practice. Help reduce congestion on channel 16.



Commercial

Channels: 7, 8, 9, 10, 11, 18, 19, 67, 79, 80, [88]

Vessels: Those used primarily for commercial transport of persons or goods, or engaged in servicing other vessels

Use: Communications pertaining to the purpose for which the vessel is used

Between: Commercial transport vessels (ship-to-ship) or between commercial transport vessels and limited coast stations

Channel 8, 67 and 88 may not be used for ship-to-coast communications

Recreational boats are not permitted to use these channels

Channel 88 not available on Great Lakes and St. Lawrence Seaway.



Marine Operator

Channels: 24, 25, 26, 27, 28, 84, 85, 86, 87, 88

Vessels: Any

Use: To place a telephone call to any location in the world or to a vessel outside of your transmitting range

Between: Vessels and public coast stations

Comments: Contact the marine operator on the channel assigned to your navigating area. If unable to determine this channel, use channel 16.

Be patient. Do not interrupt calls in progress. Avoid excessive calling if the operator does not answer - give the operator a chance to reply.



State Control

Channel: 17

Vessels: State and local government

Use: Coordination, regulation and control of boating activities and the rendering of assistance to vessels.

Between: Ship and coast stations associated with state and local governments.



Environmental

Channel: 15

Vessels: Any (receive only)

Use: Broadcast of information concerning the environmental conditions in which vessels operate - weather, sea conditions, time signals, notices to mariner, hazards to navigation

Between: One-way broadcast from coast to ship stations

Note: Currently used for Class C EPIRB emergency signals.



Weather

Channels: WX1, WX2, WX3

Vessels: Any

Use: Continuous weather information from NOAA (National Oceanic and Atmospheric Administration)

Between: One-way broadcast from NOAA to any interested parties

Comments: Receive only. You are not allowed to transmit on these frequencies.

PHONETIC ALPHABET:

To help make call letters more clearly understood, and to assist in spelling out similar sounding or unfamiliar words, radiotelephone users employ the international phonetic alphabet.

Phonetic Alphabet:

A - ALPHA	N - NOVEMBER
B - BRAVO	O - OSCAR
C - CHARLIE	P - PAPA
D - DELTA	Q - QUEBEC
E - ECHO	R - ROMEO
F - FOX-TROT	S - SIERRA
G - GOLF	T - TANGO
H - HOTEL	U - UNIFORM
I - INDIA	V - VICTOR
J - JULIET	W - WHISKEY
K - KILO	X - X-RAY
L - LIMA	Y - YANKEE
M - MIKE	Z - ZULU